IN SENATE OF THE UNITED STATES.

February 18, 1845.

Submitted, and ordered to be printed.

Mr. Woodbridge made the following

REPORT:

[To accompany joint resolution S. 22.]

The Committee on Commerce, to which was referred the memorial of Doctor Silas Meacham, respectfully report:

That they have examined the subject referred to them as minutely as a proper regard to the various and important matters referred to them would permit. They have considered the reports and testimonials of scientific gentlemen, which are hereto appended, and they have had the benefit of the personal explanations of the memorialist, and are impressed by the belief that the improvements proposed in the manner of constructing the lamp and reflectors for the lanterns, &c., may prove to be most valuable and important. But they are also of the opinion that, in a matter so deeply interesting to those engaged in the navigation of the United States, it is not wise nor expedient to change the system hitherto pursued, by the adoption of any new one, except with great caution, nor until, by actual experiment, the new plan proposed shall have been subjected to the test of actual experiment. They therefore return the memorial, with the documents which have been considered by them, and report the form of a joint resolution, which they respectfully recommend for adoption.

To the honorable the Senate and House of Representatives of the United States:

Your memorialist, a citizen of Chicago, and State of Illinois, respectfully represents: That for the last two years he has been engaged in investigating the subject of making light from the combustion of oil and lard. That, during the early part of his investigation, he ascertained that the amount of light obtained from a given quantity of oil, when consumed in an ordinary light-house lamp, was much less than the same quantity was capable of giving, if consumed in a lamp so constructed as to suffer no waste, and to cause a large amount of carbon to be precipitated in a small space, and

then by an increase of heat to be rendered highly incandescent. Such a lamp your memorialist has constructed, which, on a comparative trial with the ordinary light-house lamp, was found to give more than four times the quantity of light afforded by the latter, each consuming the same quantity of oil in the same time; and by a very simple addition to his lamp he has rendered it capable of keeping lard fluid during our coldest winter nights.

Your memorialist has also made several other important improvements in the light apparatus and light-house lantern, for a detailed account of all of which, and the beneficial results derived from them, he would respectfully refer your honorable bodies to the accompanying documents, furnished by the Treasury Department.

Your memorialist prays Congress to pass an act authorizing and requiring the Secretary of the Treasury to contract with him for his improvements, and to introduce them into the light-houses of the United States, for an amount not less than one-half of the saving that shall accrue from their use during a period of seven years; or to pass such other act as the wisdom of Congress may devise, whereby the public may enjoy the advantages of his improvements, and your memorialist receive a suitable compensation therefor.

SILAS MEACHAM.

TREASURY DEPARTMENT,

Fifth Auditor's Office, January 6, 1845.

SIR: Doctor Silas Meacham, of Chicago, Illinois, having alleged that he has made important improvements in the lamp for light-houses, and in the mode of fitting up the lamps and reflectors in the lanterns of the light-houses, I requested the favor of Professor Walter R. Johnson, who is at present in this city, to examine the subject, and report to me his opinion thereon.

He has obligingly done so; and his report upon the subject, together with a letter and several papers communicated by Mr. Meacham, I have the honor herewith to enclose, with a request that you will communicate the whole to the Senate of the United States, to whom the joint report of Mr. Johnson, Mr. Cresson, and Mr. Smith, on the gas light at Christiana, was lately communicated.

I have the honor to be, respectfully, sir, your obedient servant,

S. PLEASONTON.

Hon. GEORGE M. BIBB,
Secretary of Treasury.

WASHINGTON, *January* 3, 1845.

DEAR SIR: I have to acknowledge the receipt of your note of yesterday, by the hands of Dr. Meacham, relative to his improvements for light-houses. He has exhibited to me the more important parts of his arrangements; and has explained others, of which models could not be conveniently produced, but of which the effects are not the less readily understood. I have

also examined some certificates (copies of which are herewith transmitted) relating to experiments made on the ordinary light-house lamps, compared with the improved lamp adopted by Dr. Meacham; together with several statements of observations on the appearance of the light-house by navigators and others, who give the results of their experience, and aver the superiority of the improved over the old light, used prior to Dr. Meacham's modifications. I may state that the improvements introduced by Dr. Meacham contemplate the use of either lard or oil for fuel; and that the body of the lamp, or reservoir for the liquid, is of the same general form as those already in use.

The *first* modification of the ordinary light-house burner consists of a cone placed over the flame, similar in all respects to that of the well known solar lamps. This concentrates the outer current of air, directing it on the flame, and tends to diminish the diameter of the light, increasing at the same time its intensity.

The *second* is a diminution of the space usually left between the wick and the exterior or containing tube of the burner. This prevents the unnecessary and wasteful exposure of a large surface of oil to evaporation at a high temperature, which is no inconsiderable source of waste and of other annoyances.

The *third* alteration made by Dr. Meacham is a diminution of the diameter of the interior tube to about half an inch, with a proportionate reduction of the size of the wick. This concentrates the luminous flame, burns more matter in a given space, and with a higher intensity of light. For the same purpose, the thickness of the wick is diminished.

The *fourth* alteration consists in an exterior case or tube, four or five inches long, surrounding the container of the argand burner, and fitting close to the solar cap above mentioned. Within this tube all the air which supplies the outside of the flame is compelled to pass, and to become heated by the otherwise waste heat of the container, which is ordinarily heated above the boiling point of water. This heating of the exterior as well as of the interior current of air affords an advantage not obtained in the ordinary solar lamp, in which the heating is mainly confined to the space within the conical cap itself.

The *fifth* modification consists of a tube twelve or fourteen inches long, connected with and passing through the dripping cup, so as to elongate downwards the interior tube of the burner. The effect of this tube is to shorten the flame, and give clearness and uniformity to the light, by limiting and regulating the supply of air.

The *sixth* alteration has particular reference to the use of lard. It consists in shortening the horizontal or rather the *inclined* tube which connects the reservoir of oil with the burner, and passing centrally through it a metallic rod, connected with the interior tube, by which means the heat of the latter is conducted through the arm, and into the body of the lard. The tube and reservoir are further rendered capable of keeping the lard fluid, by being clothed with felt, or other good nonconducting materials, and having a curved conductor of heat coming from the top of the glass chimney down into the reservoir, to meet the conductor from the bottom of the inner tube just mentioned. These means of preserving fluidity appear to me competent to their object.

The *seventh* improvement consists in placing above each glass lamp

chimney a metallic tube, passing into one common chimney of larger dimensions, which traverses the top of the lantern, and, by a suitable hood and vane, is always sure of possessing a sufficient draught to carry off the products of combustion. This avoids several evils now felt in the ordinary arrangements of the lantern. The carbonic acid generated is prevented from remaining in the lantern; the watery vapor is not condensed on the interior of the panes comprising the lantern; and the vaporized oil, having no escape except through the glass chimney of the lamp and the tube above it, is no longer found dimming the glasses and tarnishing the mirrors.

In order to augment the divergency of rays, Dr. Meacham carries the centre of his flame nearer the apex of the mirror than in the ordinary light-house practice, by which means a smaller number of burners is made capable of illuminating the circuit of the horizon. To obviate the condensation of vapor and the formation of ice on the panes of the lantern, he places the reflectors nearer than heretofore to their surface. By this means, the whole of the light from each reflector passes through a single large pane of plate glass, kept so warm that no vapor can settle upon it. In constructing the lantern, he proposes that the upright posts or bars of iron constituting its support shall be placed with their edges towards the centre of the lantern, instead of their flat sides, as at present.

By the details of an experiment, certified by Mr. James Long and Mr. Thomas B. Carter, it appears that the old light-house lamp consumed per hour 1.1037 ounce of oil, and the improved lamp of Dr. Meacham, 1.458 ounce. It also appears that the light furnished by the unit weight of oil when burned in the former lamp was 327.08 and by the same weight in the improved lamp 1515.1—showing that the relative efficiencies of the two lamps were as 1 to 4.632. As the respectability of the parties making these observations is fully certified, I do not feel at liberty to doubt the correctness of their statements.

The letter of Captain E. B. Ward and that of Captain F. C. Owen appear fully to establish the fact that a great improvement has been made in the Chicago light, while under the superintendence of Dr. Meacham. They are understood, however, to refer to light produced, not by the more recent improvements above detailed, but to that given by lamps with the solar cap only, similar to that tried by Dr. Blaney, as detailed in his certificate, and witnessed by Dr. Brainard. In that lamp it appears that the intensity was 3.3 as great as in the old light-house lamp, with a consumption of about 50 per cent. more oil, which would make the efficiency of the improved lamp *then tried* 2.2 times as great as that of the ordinary lamp.

The improvements which Dr. Meacham has sought to effect are all worthy of consideration, the means adopted are simple and intelligible, and, if reliance is to be placed on the statements of gentlemen who have recorded their experiments relative to the economy which they effect, there can be no doubt of their great utility. As above stated, I see no reason to discredit those statements; and even if such a doubt existed, the means of verification are so easily procured, that any material error could be at once detected.

I am, very respectfully, your obedient servant,

WALTER R. JOHNSON.

STEPHEN PLEASONTON, Esq.

CHICAGO, *April* 11, 1844.

SIR: It affords me great pleasure to inform you that the lights at Chicago during the past week have exhibited a degree of beauty and brilliancy exceeding any lights I have ever seen.

On the nights of the 8th and 10th instant, I saw the lights at the almost incredible distance of thirty miles. Whether the great distance at which they were seen was owing to the peculiar state of the atmosphere, or to the superiority of the light, or partly to both, I am not prepared to say; but that the light is decidedly superior to any other on the Northern lakes is beyond a doubt.

My occupation as a master of sail and steam vessels during the last twelve years has rendered me familiar with all the lights on the lakes; and while sailing the mail steamer between Chicago and St. Joseph, I have an opportunity of witnessing your light six nights each week, and any change for the better or poorer could not escape my attention.

There are few individuals more deeply interested in the success of our lights than myself, and every improvement is hailed with gratitude and pleasure.

Respectfully, your obedient servant,

E. B. WARD,

Master of the Mail Steamer between Chicago and St. Joseph.

Dr. MEACHAM,

Keeper of the Light-house at Chicago, Illinois.

CHICAGO, *April* 19, 1844.

At the request of Dr. Silas Meacham, I have examined the improvement which he has introduced into the Chicago light-house at this place.

By the addition of the frustrum of a hollow cone placed over the circular wick, the draught of the argand burner is much increased, with the following results:

1st. Greater amount of combustion in a given time, without smoke. As a result of this, a greater amount of carbon is precipitated within the flame, and, from the increased intensity of the heat, is brought to a higher state of incandescence. As the intensity of the light of flame depends upon the amount of solid matter precipitated and the intensity to which it is heated, the addition of Dr. Meacham to the burner materially increases the intensity of the light.

2d. A contraction of the flame, in the direction of its horizontal diameter. In consequence of this, a greater amount of gas being consumed within a given space, the intensity of light is increased. The smaller size of the flame allows of its being placed with more accuracy in the focus of the paraboloid reflector, and thus probably increases the power of the mirror to throw off the parallel rays.

At the request of Dr. Meacham, I have measured as accurately as possible the comparative intensity of a lamp furnished with his addition, and that of one formerly used in the light-house. The photometer which I used was that suggested by Count Rumford, viz: a comparison of the depth of shadow produced by the two lights.

A lamp with the improvement of Dr. Meacham gave by this mode an

intensity 3.3 greater than that of the former arrangement. Six lamps with the addition burn somewhat less oil than nine of the old ones in the same time. By calculations, I have determined, that if the quantity of light emitted by nine lamps, as formerly used, be taken at eleven, that of six with Dr. Meacham's addition would be twenty-six, both burning the same quantity of oil in the same time.

These results are in my opinion obtained by correct calculations, conducted upon proper scientific principles.

JAMES V. Z. BLANEY, *M. D.*,
Professor of Chemistry, &c., in the Rush Medical College.

CHICAGO, ILLINOIS, *April* 19, 1844.

Having witnessed a trial of the comparative intensity of the lamp as improved by Dr. Silas Meacham, and that formerly made use of in the light-house at this place, I am of opinion that the light of the former excels that of the latter to a degree as great at least as that stated in the accompanying account by Dr. Blaney.

DANIEL BRAINARD, *M. D.*,
Professor of Anatomy, &c., in the Rush Medical College.

PORT OF CHICAGO, *April* 27, 1844.

SIR: On Wednesday night last, I had an opportunity of observing the light of the Chicago light-house, from the lake, as I was approaching Chicago, and I have no hesitation in stating that it is the best light I ever saw on the Northwestern lakes; and last night I witnessed at the light-house the very striking difference in the quantity and brilliancy of the light between two lamps—the one burning in the old and common way, and the other with your improvement. I have no doubt the five lamps with your improvement which you burn now make a much greater and better light than the nine you formerly burned in the old way.

Respectfully, yours,
F. C. OWEN,
Master of the Schooner Alps.

Dr. S. MEACHAM,
Light-house Keeper, Chicago.

Experiment made June 24, 1844, to test the comparative intensity of light made by an ordinary light-house lamp, and a lamp constructed by myself, with the quantity of oil consumed by each in three hours' time, as witnessed by James Long and T. B. Carter, Esquires:

Weight of lamps when filled with oil.

	Lbs.	oz.	drs.		Lbs.	oz.	drs.
Light-house lamp -	7	5	0	Improved lamp -	5	7	6
After burning 3 hours -	7	1	11	After burning 3 hours -	5	3	0
Oil consumed -		3	5	Oil consumed -		4	6

The lamps were placed sixty-six inches apart, and the photometer on a line between them.

	Inches.		Inches.
Distance of light-house lamp from centre of photometer - -	19	Distance of improved lamp from centre of photometer	47
	19		47
	171		329
	19		188
Square of distance -	361	Square of distance -	2209

361) 2209 (6.11
2166

430
361

690

The intensity of light from the improved lamp was 6.11 greater than the light-house lamp; but as the improved lamp consumed 17 drachms more oil than the other, a proportional reduction must be made from its light. Let the light of the old lamp be represented by 10; then, if three ounces five drachms give 10, four ounces six drachms give 13.2. Therefore, (omitting fractions,) if the intensity of light given by the light-house lamp be taken at 13, that from the improved lamp will be 60, both consuming the same quantity of oil in the same time.

SILAS MEACHAM.

This is to certify, that I attended at the house of Dr. Meacham at a trial made with two lamps, one of which was of his own construction, and the other one of the ordinary light-house lamps, and was present during the whole time, and assisted in weighing the lamps before and after burning, and that the statement made above is in every particular correct. Dr. Meacham's new lamp is of simple construction, easily managed, and cannot cost more than those now in use.

JAMES LONG.

This is to certify, that I was present part of the time the experiments were making with the two lamps, as above described, and am fully satisfied of the superiority of the new lamp over the old light-house lamp, even to the extent of the intensity of light found in the statement made by Dr. S. Meacham; and that the certificate in regard to the weight of each, made by Mr. Long, is in my opinion perfectly correct and satisfactory.

THOMAS B. CARTER.

STATE OF ILLINOIS, }
County of Cook, } ss.

I, Samuel Hoard, clerk of the circuit court in and for the county of Cook, Illinois, do hereby certify that I am personally acquainted with Messrs. Long and Carter, whose certificates are appended to the statement of Dr. Meacham, and that they are gentlemen of high respectability, intelligence, and veracity, whose statements are entitled to implicit confidence.

In testimony whereof, I have hereunto signed my name and affixed the [L. S.] seal of said court, at Chicago, this 25th day of June, A. D. 1844.

SAMUEL HOARD, *Clerk*.

WASHINGTON, *January* 4, 1845.

SIR: Having by your request submitted to Professor Johnson, for his examination, a model of the most important parts of my improved light-house lamp, and explained to him the other parts, together with various other improvements in the light-house lantern and the light apparatus, it may not be improper to state briefly the advantages that result from my improvement.

All the vaporized oil, being compelled to pass through the wick, is ignited, and forms a component part of the flame; the outer and inner currents of air, being heated by the waste heat of the burner, and regulated both in force and quantity, are made to impinge at a suitable angle on the flame, so as greatly to contract its diameter; consequently, a greater amount of solid matter is precipitated and rendered highly incandescent in a given space, and a great increase of intensity and brilliancy of light is produced from a diminished quantity of oil.

The alteration I propose in the arrangement of the flame in relation to the reflector is, to remove the flame to that point between the focus and vertex of the reflector which will secure a divergence of the reflected rays equal to eighteen degrees from its axis. This alteration will secure, at least, in a 16-inch reflector, fifteen per cent. more *reflected* light than is obtained from the usual mode of adjustment. And I may be allowed to observe, that the *reflected light* is the only *efficient* light in illuminating the distant horizon.

I have found that ten of my improved lamps, placed in a horizontal circle, with the reflectors properly adjusted, is as large a number as is desirable to illuminate the whole circle of the horizon to the distance of thirty miles, when the atmosphere is clear.

From numerous, varied, and in some instances long-continued experiments, many of which were witnessed by disinterested and intelligent gentlemen, (the certificates of some of them have been laid before you,) I have no hesitation in stating that the adoption of my improvements will diminish the annual expenditure for light-house supplies fully one-third; and if lard should be substituted for oil, a further reduction will be made, nearly equal to the difference in the price of the two articles.

The other improvements which I have made, for carrying off the carbonic acid and other products of combustion, and to prevent the condensation of vapor and the formation of ice on the glass of the lantern, can be justly

appreciated only by those who are familiar with the details of light-house keeping, and the varied and injurious annoyances which they in a great measure overcome.

I am, respectfully, your obedient servant,

SILAS MEACHAM.

STEPHEN PLEASONTON, Esq.,
Fifth Auditor of the Treasury.

NEW HAVEN, CONN., *January* 27, 1845.

SIR: Your letter of introduction secured for me a very courteous reception from Professor Silliman, whom I found very busy in making arrangements for his departure for New Orleans to-morrow morning. His circumstances did not permit him to witness any experiments, but he examined Professor Johnson's report, (a *copy* of which I had with me,) and, with a common astral lamp before him, he made several inquiries, to enable him the better to understand the nature of my improvement, and the results to be expected from it.

I enclose to you Professor Silliman's statement.

Professor Silliman expressed a strong desire that at least one light-house on the Sound, and near him, might be fitted up with my improved lamps, that he might personally inspect it, and witness its effect.

I respectfully request that suitable measures may be adopted, to enable me to fit at least three light-houses with my improved lamps during the ensuing summer, one on the Northwestern lakes, one on Long Island sound, and one conspicuous sea light on the Atlantic coast.

I desire you to communicate my request to Judge Huntington, the chairman of the Committee on Commerce; and oblige, sir, your obedient servant,

SILAS MEACHAM.

Hon. WILLIAM WOODBRIDGE,
United States Senate.

NEW HAVEN, *January* 27, 1845.

Dr. Meacham, of Chicago, introduced to me by Governor Woodbridge, of the United States Senate, has communicated to me a document dated January 3, 1845, and signed by Professor Walter R. Johnson, in whom I have great confidence.

This paper describes an improved lamp for light-houses, and states the results of experiments made with it.

As far as I can form an opinion of a thing which I have not seen, and of results which I have not witnessed, I am ready to state that my impressions are very favorable to Dr. Meacham's plan and object. They appear to me to be well worthy of a fair trial in the light-houses on our shores; and, should I have an opportunity to see his experiments, I might then be able to give an opinion more worthy of attention.

B. SILLIMAN.